Skiing, Mountain Biking, and Motorsports

Fast-Moving Group Coordination

Mesh networking works well for groups spread across dynamic environments - ski resorts, trail systems, and off-road courses - where cellular coverage is patchy and voice radio is impractical. Delivery is best-effort over LoRa, with no guaranteed delivery: messages and positions can be delayed, stale, or missing where nodes are out of range. Treat it as a coordination aid, not a safety or rescue system. Text-based mesh communication provides:

- Asynchronous messaging that doesn't require everyone to be listening simultaneously
- Position tracking on a shared map so support vehicles or guides know where riders are (positions are periodic and may be stale)
- No ongoing subscription costs compared to satellite communicators

Ski Resort Scenario

A typical ski resort deployment looks like:

- **Base node** at the lodge or parking area - plugged into power, acts as a gateway if internet access is available
- **Summit repeater** - many resorts already have communication infrastructure at the top; a solar-powered or battery-backed repeater here provides coverage across the mountain
- **Personal nodes** on each skier - small device in a jacket pocket or pack

Coverage inside chairlift cabins and trees can be spotty - expect short message delays rather than instant delivery. Messages sent while a node is out of range are generally lost: the mesh does NOT automatically retry and catch up by default. Recovering missed messages requires a Store & Forward server (an ESP32 device with onboard PSRAM running on a private channel - Store & Forward is refused on the default public channel), and the client must then explicitly request the missed history. Do not rely on automatic catch-up delivery.

Mountain Biking Trail Networks

Trail systems can be extended with simple infrastructure nodes:

- Small solar-powered repeater in a weatherproof enclosure mounted at trail junction kiosks or on trees at high points
- Battery-powered repeater in a waterproof box works well for seasonal deployment - install at the start of the season, recover at the end
- Even one well-placed repeater at a summit or ridge can dramatically extend coverage across an entire trail system

Motorsports: Off-Road Racing and Overlanding

Mesh networking can be used in off-road motorsports for convoy coordination and driver-navigator communication:

- **Convoy position tracking:** each vehicle's position appears on the map view, letting support vehicles follow the convoy's progress without voice radio check-ins
- **Driver-to-navigator text:** eliminates voice radio clutter; the navigator can send turn notes as text while the driver focuses on the road
- **Support vehicle coordination:** sweep vehicles can see the full convoy spread and know where stragglers are without repeated radio calls

Vehicle Mounting for Better Range

Handheld devices inside a vehicle cab perform poorly - the metal body acts as a Faraday cage. For serious use:

- **Magnetic-base NMO antenna mount** on the roof, connected via SMA adapter to the mesh device inside - this dramatically improves range vs. a device sitting on the dashboard. Use an antenna tuned for the 902-928 MHz band (not a VHF/UHF whip), and keep the coax run short and low-loss; an off-band antenna will not help and can hurt performance.
- Route the coax through a window gap or door seal to keep the device accessible inside the cab
- A roof-mounted antenna provides near-omnidirectional coverage with no body blockage

Device Recommendations for Action Sports

Smaller and lighter is better for action sports use:

- **LILYGO T-Echo** - fits in a jersey pocket or chest pack, built-in GPS, ePaper screen readable in sunlight. It runs on an internal, USB-C-rechargeable ~850 mAh Li-Po cell (no AAA or replaceable cells; the battery is built in).
- **T-Beam** - bulkier and heavier; better for vehicle mounting than body-worn use
- Use a silicone protective case or a small dry bag for rain and mud protection
- Secure the device so it won't shift or be damaged in a crash - a chest pocket or internal pack pocket is better than an external clip in rough conditions

Power in Vehicles

For continuous in-vehicle operation, power the mesh device from the vehicle's electrical system:

- 12V accessory socket to 5V USB adapter for any USB-C or Micro-USB device
- For permanent installations, tap a switched 12V circuit (ignition-controlled) so the device powers off with the vehicle
- A continuously powered gateway node with internet access enables real-time MQTT position forwarding to a server during an event

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